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NASA-02312 (June 2004)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Superseding NASA-02312 (December 2003)

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DIVISION 02 - SITE CONSTRUCTION

SECTION 02312

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

06/04

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NATIONAL AERONAUTICS **NASA**
AND SPACE ADMINISTRATION **Superseding NASA-02312**
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SECTION 02312

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES
06/04

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers excavation, trenching, backfilling, and restoration of paved surfaces for utilities system.

Drawings must include the following:

Limit of specified work, indicating the distance from the building line

Locations and depths of excavations

Trench cross section

Earthwork to accommodate the structure is specified in Section 02311, "Excavating, Backfilling and Compacting for Structures."

Placing topsoil is specified in Section 02920, "Lawns and Grasses."

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

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The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145 (1991; R 2003) Classification of Soils and

	Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	(2001) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 2	(2000) Sampling of Aggregates
AASHTO T 87	(1986; R 2000) the Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C3	(1988) Piles - Preservative Treatment by Pressure Processes

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2001) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	(2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2922	(2001) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(2001) Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction
ASTM D 422	(2002) Standard Test Method for Particle-Size Analysis of Soils
ASTM D 4318	(2000) Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

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The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Record of Existing Conditions shall be submitted in accordance with the paragraph entitled, "Records of Existing Conditions," of this section.

The records shall include the following:

Location of Underground Utilities
Location of Approved Utilities
Location of Test
Location of Inspection

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

SD-06 Test Reports

Test reports shall be submitted in writing by the Contractor for Soil Test results within 5 calendar days. Reports shall be according to the paragraph entitled, "Field Quality Control," of this section.

SD-07 Certificates

Certificates for the following shall be submitted by the Contracting Officer in accordance with the paragraph entitled, "Plans," of this section.

Demolition Plan
Work Plan
Protection Plan

Certificates for Proposed Soil Materials shall be submitted by the Contracting Officer in accordance with paragraph entitled, "Proposed Soil Materials," of this section.

Certificates for Compost shall be submitted indicating grade and compliance to state and local regulations.

1.3 QUALITY ASSURANCE

[Soil testing service will be provided by the Government. Testing service will include testing soil materials proposed for use in the work , subbase materials at the mixing plant, and field-testing facilities for quality control testing during construction period.]

[Soil survey for satisfactory soil materials and samples of soil materials shall be furnished by the Contractor. A certified soil-testing service approved by the Contracting Officer shall be provided by the Contractor. Testing shall include soil survey for satisfactory soil materials, sampling and testing soil materials proposed for use in the work, subbase materials at the mixing plant, and field-testing facilities for quality control

during construction period.]

Testing agencies shall conform to the requirements of ASTM D 3740.

1.4 PLANS

The Demolition Plan shall be approved by the Contracting Officer at least 48 hours in advance of the work. The plan shall include all special environmental consideration and safety precautions along with the coordination procedures for the protection plan and work plan of this phase of work.

A Work Plan shall be submitted including proposed methods of excavation, earth support, utility construction, and backfilling at least 48 hours in advance of the work, for approval by the Contracting Officer. The plan shall be coordinated with the demolition and protection plans of this section.

The Contractor shall provide a Protection Plan of existing utilities place, and coordinate the plan with the demolition plan.

1.5 DRAWINGS

As-Built Drawings shall be submitted in accordance with Section 01780, "Closeout Submittals."

1.6 RECORDS OF EXISTING CONDITIONS

The Contractor shall verify the existing conditions are correct as shown on the plans and mentioned in the specification. Any discrepancies found shall be noted immediately, and notification given to the Contracting Officer.

The records shall include Location of Underground Utilities, Location of Approved Utilities, Location of Test and Location of Inspection.

PART 2 PRODUCTS

2.1 STRUCTURAL MATERIALS

Materials used for shoring and bracing, such as sheet piling, uprights, stringers, and crossbraces, shall be in good serviceable condition. Any timber used shall be sound and free from large or loose knots.

Pressure-treated timber shall be used where wood sheeting or piling is specified or indicated to be cut and left in place. Timber and treatment shall conform to AWPA C1. Pressure treatment for piles shall conform to AWPA C3. [Creosote retention shall be not less than 2 pounds per cubic foot 192 kilogram per cubic meter.] [Chromate Copper Arsenate (CCA) retention shall be not less than 0.8 pounds per cubic foot 13 kilogram per cubic meter.]

2.2 BACKFILL MATERIAL

Backfill material shall consist of sandy clay, sand, gravel, soft shale, or other satisfactory soil materials.

2.2.1 Proposed Soil Materials

Soil materials proposed for use in the work shall be tested. The materials

shall be approved by the Contracting Officer prior to start of work, as follows:

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Satisfactory soil materials	Sampling	AASHTO T 2	One for each source of material to determine conformance to definition of satisfactory soil materials; additional tests whenever there is any apparent change
	Preparation of samples	AASHTO T 87	
	Sieve analysis of fine and coarse aggregate	ASTM C 136	
	Mechanical analysis of soils	ASTM D 422	
	Liquid limit of soils	ASTM D 4318	
	Plastic limit and plasticity index of soils	ASTM D 4318	
	Moisture-density relations of soil	AASHTO T 180, Method B or D	

2.2.2 Satisfactory Materials

Satisfactory soil materials - AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

2.2.3 Unsatisfactory Materials

Unsatisfactory soil materials - AASHTO M 145 Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, highly organic soils, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.3 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam. The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable materials larger than 2 inch 50 millimeter in any dimension.

2.4 COMPOST

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NOTE: Insert grade or class of compost suitable for the surface required. Insert local or state regulation defining class or grade of compost. Where local or state regulations do not define grade or class, insert requirements for screening to limit

particle size.

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Compost shall be yard trimmings or yard waste compost processed and graded according to state and local regulations. Compost shall be grade [_____] as defined by [_____].

2.5 TOPSOIL BLEND

Where insufficient topsoil is removed from the project site the topsoil removed shall be stockpiled and blended with compost at the site to achieve the required volume.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Before starting earthwork, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

Excavation, filling, backfilling, and grading shall be to subgrade elevations specified.

Excavated materials suitable for backfill shall be piled in an orderly manner sufficiently distant from excavations to prevent overloading, slides, and cave-ins.

Excavations shall be done in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

3.2 PROTECTION OF PERSONS AND PROPERTY

Excavations shall be barricaded and posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness.

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage including settlement, lateral movement, undermining, and washout.

Topsoil removal operations shall be conducted to ensure safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

3.3 SHORING, BRACING, AND SHEETING

Shoring and bracing in excavations shall be maintained for the entire length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

Sheeting used to prevent lateral movement of soil shall be removed in accordance with the requirements.

Untreated sheeting shall not be left in place beneath structures or pavements.

3.4 TRENCH EXCAVATION

Trenches shall be of adequate width and depth for the specified purpose. Side slopes of the trenches shall be as nearly vertical as practicable. Care shall be taken not to overexcavate. Bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length except where it is necessary to excavate for bell holes and for proper sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded to ensure that the pipe rests on the prepared bottom for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint. Stones shall be removed, as necessary, to avoid point bearing. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6-inches 150 millimeter below the trench depth specified. Except as specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench, it shall be removed and the trench shall be backfilled to the proper grade with coarse sand, fine gravel, or other suitable, approved material.

Trench excavations in surfaced areas shall be by open cut, unless otherwise shown. The pavement shall be cut by concrete saw or other approved method. Cuts shall be in straight lines parallel to the utility line location and shall be to a depth of at least one quarter of the pavement thickness. The remainder of the pavement shall be broken out. Pavement shall be removed a minimum of 12 inches 300 millimeter on each side of the trench and 6 inches 150 millimeter beyond where the base course is to be removed.

3.5 WATER REMOVAL

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NOTE: Additional specifications may be needed where more elaborate dewatering systems are necessary, such as may be required to reduce hydrostatic pressures, lowering level of watertable to specific elevations, etc.

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Water shall not be permitted to accumulate in excavations. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.6 EXCAVATION FOR SANITARY SEWERS AND STORM SEWERS

The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8 inches 200 millimeter or be less than 5 inches 125 millimeter on either side of the pipe. The width of the trench above that level shall be as wide as necessary for sheeting and bracing and for the proper performance of the work.

For pipe indicated resting on the trench bottom, the bottom of the trench shall be rounded so that the pipe shall nest firmly on undisturbed soil for as nearly the full length of the barrel (as proper jointing operations will permit). This part of the excavation shall be done manually only a few feet meter in advance of the pipe being laid.

Depth of excavation for gravity sewer lines shall permit the installation of the pipe at the flow line elevations shown on the plans.

3.7 EXCAVATION FOR WATER DISTRIBUTION SYSTEM

Trenches shall be graded to avoid high points that necessitate placing vacuum and relief valves in the waterlines. If a profile of the pipes is not provided, trenches shall be of a depth to provide a minimum cover over the top of the pipe of 2-1/2 feet 762 millimeter from the existing ground surface or the indicated finished grade (whichever is lower) and at additional depth if necessary to avoid interference of the waterlines with other utilities.

3.8 EXCAVATION FOR GAS DISTRIBUTION SYSTEM

Trenches for gas distribution lines shall be excavated to a depth that will provide not less than 2 feet 600 millimeter of cover over the top of the pipe from the existing ground surface or from the indicated finished grade (whichever is lower).

3.9 EXCAVATION FOR ELECTRICAL UTILITIES

Excavation of trenches for electrical cables and duct lines shall provide vertical walls, unless otherwise approved by the Contracting Officer, and the trench shall be only as wide as necessary for workers to install the cables or ducts. Abrupt changes in grade of the trench bottom shall be avoided. Trenches shall be of a depth to provide a minimum cover over the top of the cables or ducts of 2-feet 600 millimeter below finished grade, and at additional depth if necessary to avoid interference of the electrical cables or ducts with other utilities.

3.10 EXCAVATION FOR APPURTENANCES

Excavation for manholes and similar structures shall be sufficient to leave at least 12 inches 300 millimeter in the clear between the outer surfaces and the embankment or timber used to hold and protect the walls. Any overdepth excavation below such appurtenances that has not been directed will be considered unauthorized and shall be refilled with select bedding material or concrete, as directed by the Contracting Officer, at no additional cost to the Government.

3.11 BORING AND JACKING

Where utilities beneath concrete and asphaltic pavement shall be installed

by boring and jacking, The boring and jacking installation shall be performed by workers experienced in such operations, with equipment designed and regularly used for this work. The bored opening shall be kept to the minimum size practical for the installation of the utility. When a void greater than 1 inch 25 millimeter exists between the bored opening and outside edge of the utility installation, the void shall be filled with grout under pressure, as approved by the Contracting Officer.

3.12 BACKFILLING AND COMPACTION

Where trench sheeting is pulled, withdrawal shall be in increments of not more than 1 foot 300 millimeter and backfilling and compaction operations shall be carried on simultaneously with trench sheeting pulling.

Trenches shall not be backfilled until required tests are performed and until the utilities systems, as installed, conform to the requirements for the installation of the various utilities. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

3.12.1 Bedding

Where the trench is excavated in rocks, a minimum of 6 inches 150 millimeter of specified bedding material shall be placed on the rock surface before laying conduit or electrical cable.

3.12.2 Backfill Around Pipe

Backfill around pipe shall be applied to 6-inches 150 millimeter above pipe with the specified bedding material.

3.12.3 Lower Portion of Trench

Backfill material shall be deposited in 8-inch 200 millimeter uncompacted layers and compacted to the density of the adjacent soil until there is a cover of not less than 1 foot 300 millimeter. The backfill material in this portion of the trench shall consist of sandy clay, sand, gravel, soft shale, or other approved materials, free from hard clods and stones larger than 1 inch 25 millimeter in any dimension.

3.12.4 Remainder of Trench

The remainder of the trench shall be backfilled with material that is free of stones larger than 3 inches 75 millimeter in any dimension. Backfill material shall be deposited in layers not exceeding the thickness specified, and each layer shall be compacted to the minimum density specified.

Under concrete slabs and paved parking areas:

6-inch 150 millimeter layers, 95 percent of maximum density prescribed in AASHTO T 180, Method B or D

Under other areas:

8-inch 200 millimeter layers, 90 percent of maximum density prescribed in AASHTO T 180, Method B or D

3.13 FIELD QUALITY CONTROL

The Contractor shall arrange his Soil Test work so that sampling and testing may be performed without interruption. Moisture-density relations shall be determined in accordance with AASHTO T 180, Method B or D. Field density tests shall be performed by methods in sufficient number to ensure that the specified density is obtained.

Soil materials shall be tested during construction as follows:

MATERIAL	REQUIREMENT	TEST METHOD	MATERIAL TESTED AND NUMBER OF TESTS
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556, Sand Cone Method or ASTM D 2922, Nuclear Method (when approved by Contracting Officer)	At least three daily for each subgrade soil material, and for each layer of soil material; additional test whenever there is in moisture

3.14 RESTORATION OF SURFACES

Areas within the limits of earthwork under this section, including adjacent transition areas, shall be uniformly graded. The finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

Grassed areas:

The finished surface of areas to receive topsoil blend shall be not more than 0.10-foot 30 millimeter above or below the specified finish elevations.

Walks:

The surface of areas under walks shall be shaped to line, grade, and cross section, and the finished surface shall be not more then 0.0 foot millimeter above or 0.10-foot 30 millimeter below the specified finish elevations.

Pavements:

The surface of areas under pavements shall be shaped to line, grade, and cross section, and the finished surface shall be not more than 1/2-inch 13 millimeter above or below the specified finish elevations.

3.15 DISPOSAL OF EXCESS AND WASTE MATERIALS

[Excess excavated satisfactory materials shall be transported to, and disposed in, designated storage areas on Government property.]

[Waste material, including excavated unsatisfactory materials, trash, and debris, shall be transported to, and disposed in designated spoil areas on Government property.]

[Waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris, shall be removed from Government property and legally disposed of, by the Contractor.]

-- End of Section --